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A HEALTH AND AEROBIC FITNESS ASSESSMENT OF THE 2ND BATTALION, R--ETC(U)
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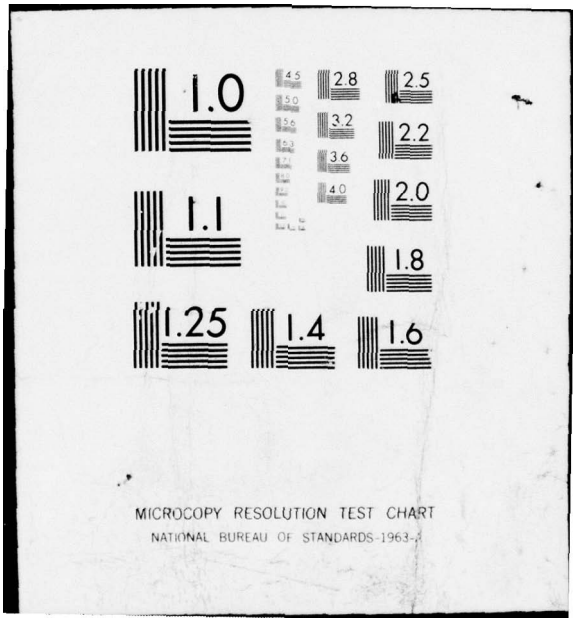
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DCIEM Technical Report No. 77X12

A HEALTH AND AEROBIC FITNESS ASSESSMENT OF THE 2ND BATTALION, ROYAL 22ND REGIMENT, QUEBEC CITY

W.S. Myles
R.D. Townshend
T.E. Brown

DEFENCE AND CIVIL INSTITUTE OF ENVIRONMENTAL MEDICINE
INSTITUT MILITAIRE ET CIVIL DE MEDECINE DE L'ENVIRONNEMENT

DEPARTMENT OF NATIONAL DEFENCE — CANADA

March, 1977

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DEPARTMENT OF NATIONAL DEFENCE - CANADA

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ABSTRACT

Aerobic fitness and body compostition were assessed for 430 members of the 2nd Battalion, Royal 22nd Regiment (2R22R) as a preliminary to a proposed unit training programme. Aerobic power (VO_2 max) was predicted from heart rate during submaximal exercise performed on the bicycle ergometer and values were categorized as poor, fair, good or excellent. Skinfold thickness was measured at three sites (triceps, subscapular and suprailiac) and a total greater than 50 mm was considered to indicate excess body fat. Among those aged 18-24 years, 81% had good or excellent levels of VO_2 max and 83% had a skinfold thickness measurement below 50 mm. These percentages declined with increasing age to become 31% and 67% among those over 40 years of age. Although the aerobic fitness level among those 18-29 years at 2R22R was appreciably higher than that of other CF personnel of comparable age, this difference was much less evident for older subjects. This report recommends that the major effort of fitness training be devoted to personnel over 24 years of age and offers some guidelines for designing a graduated programme based on walking and running.

INTRODUCTION

The Exercise Physiology Section at DCIEM was asked to carry out a health and aerobic fitness assessment of the 2nd Battalion, Royal 22nd Regiment (2R22R) in Quebec City. The unit intended to introduce a fitness training programme and wished to evaluate the initial fitness level of all personnel. In particular, it was necessary to identify those individuals for whom the training programme might consitute a health risk. It was also hoped that a knowledge of his present fitness level might motivate many individuals and help launch the training programme.

To accomplish these objectives the health and fitness assessment was administered to all personnel and the results were communicated to each individual through the auspices of the unit medical officer, (MO), and his staff. Those personnel who showed evidence of electrocardiograph (ECG) abnormalities during exercise, high blood pressure (bp) or abnormal lung function were referred to the MO for further evaluation at his discretion. This report details levels of aerobic fitness and the incidence of obesity for different age groups and compares 2R22R with average values for the Canadian Forces (CF). The results of lung function tests and the Health Hazard Appraisal questionnaire are not presented in this report.

METHODS

Aerobic power - Aerobic power (VO_2 max), a specific measure of aerobic fitness, was predicted from submaximal exercise using the MONARK bicycle ergometer. The total work period lasted ten minutes at a pedalling speed of 50 rpm. The first five minutes at a workload of 600 kg-m/min allowed the subject time to warm-up. The second five minutes workload (usually 900-1200 kg-m/min) was selected to produce a heart rate which was 70-85% of maximum predicted from age. Heart rate was recorded using a Cambridge ECG, and heart rate and workload during the final minutes were used to predict VO_2 max according to the nomogram of Astrand and Rhyming (1). Individuals were classified into one of four categories of VO_2 max proposed by Cooper (3) and shown in Figure 1.

Body Composition - Skinfold thickness was measured at three sites (triceps, subscapular and suprailiac) using Harpenden calipers. These measurements provide an estimate of body fat content since about 50% of body fat is located subcutaneously. A total for the three sites of less than 35 mm is considered lean, 35-50 mm as acceptable and more than 50 mm indicates too much body fat (relative obesity).

RESULTS

Table 1 shows mean values for VO_2 max for 2R22R divided into five age groups. Also shown are values for other CF personnel and Canadian civilians of comparable age. The data for other CF personnel were obtained during the past two years from many segments of the military population and can therefore be considered to represent a reasonable average for CF males. The data for Canadian civilians were taken from the published work of Bailey et al. (2) which used the same method as the present study. Mean values for 2R22R are slightly higher than the average for the CF. The difference is most marked in the age group 18-24 years and is virtually nonexistent at age 40-59 years. Mean values for Canadian civilians are lower than those of 2R22R for all age groups.

Table 1 shows that VO_2 max declines with aging. For 2R22R this effect is illustrated more clearly in Figure 2 where VO_2 max is plotted against age (the solid line). The broken line shows how much of this decline can be attributed to physiological aging alone. The discrepancy between the two lines probably reflects the loss of fitness due to a change in lifestyle, increasing family and job responsibilities and a decreasing interest in participating in active sports. Table 1 and Figure 2 both show that the most marked decline in fitness occurs after age 24.

Table 2 compares the mean values for VO_2 max for 18-29 year old males from 2R22R with other CF units, US infantry and NHL officials. The US infantry group were tested by US researchers in Korea where the soldiers were participating in a strenuous fitness programme (personal communication of the data to the authors). The NHL officials had just finished summer training camp where a condition of employment was to attain a minimum level of fitness. The fitness level of 2R22R compares favourably with that of other CF infantry battalions, officer candidates at CFB Chilliwack, US infantry, NHL officials and is definitely superior to that of air and sea element personnel from CFB North Bay, CFB Portage La Prairie, HMCS Huron and HMCS Okanagan. After age 29 there is little difference between 2R22R and other elements within the CF.

So far in this report only mean values for VO_2 max have been shown. An alternative approach is to categorize VO_2 max for each individual as poor, fair, good or excellent according to the age-related standards in Figure 1. Figure 3 shows the distribution into categories of VO_2 max for each of the four age groups tested at 2R22R. A similar treatment is included for other CF personnel. In addition the categories poor and fair and the categories good and excellent are combined and labelled as "unfit" and "fit", respectively. For the age group 18-24 years, the 2R22R has more individuals in the good or excellent categories (fit). The difference

between 2R22R and other CF personnel is less marked among older personnel.

A similar treatment of results can be applied to measurements of skinfold thickness. Figure 4 shows the distribution into three categories of skinfold thickness for the four age groups tested among 2R22R and other CF personnel. A skinfold thickness measurement in excess of 50 mm indicates too much body fat (relative obesity). Figure 4 shows that the incidence of skinfold thickness in excess of 50 mm among 2R22R is not markedly different from that observed among other CF personnel and that both groups experience an increased incidence after age 24.

DISCUSSION AND RECOMMENDATIONS

The results for 2R22R confirm what previous testing of other CF personnel has shown, that infantry soldiers have a higher level of aerobic fitness than the average for the CF. This is hardly surprising since infantry soldiers are one of the few segments of the military population who regularly perform hard work as part of their job. This hard work constitutes a training stimulus which produces and maintains their above average level of aerobic fitness. Sufficient data is now available to confirm that this difference between infantry and the CF as a whole is most marked in the young soldier but is not maintained in older personnel who probably have more sedentary, supervisory duties.

Infantry soldiers of 2R22R had a higher level of VO_2 max than Canadian civilians of comparable age living in Saskatoon (2). Of the 430 infantry soldiers tested, 44% were in the poor or fair category of VO_2 max (unfit). Basing his assessment on very similar criteria of fitness, Cumming (4) reported that about two thirds of the civilians tested in Winnipeg could be classified as unfit. Although it is uncertain to what extent the data for Canadian civilians reflect the national average, they indicate that 2R22R has a higher level of aerobic fitness than the civilian population. The data in Table 2 suggests that this is not the case for air and sea element personnel.

The aerobic fitness of young soldiers (18-29 years) of 2R22R compares favourably with that of other CF infantry units, officer candidates at the end of basic training, US infantry participating in a compulsory training programme and NHL officials after summer training camp and is superior to that of air and sea elements within the CF (Table 2). On the other hand, Table 1 and Figures 2, 3 and 4 all show that the deterioration in fitness begins as early as age 25. Since only 19% of those 18-24 years had a VO_2 max in the poor or fair category (Figure 3) and only 17% has a skinfold thickness in excess of 50 mm (Figure 4), the present

training regimen at 2R22R for the 18-24 age group appears to be sufficient to keep them "fit and in shape". After age 24, the percentages who were unfit or too fat increased dramatically (60% and 36% for those 25-59 years) and it is suggested that the fitness programme should be directed to those 25 and over. At the same time the 18-24 age group should be included in any educational programme to promote fitness an an important component of a healthy lifestyle.

COMMENTS ON THE PROPOSED FITNESS TRAINING PROGRAMME FOR 2R22R - A second objective in this report is to provide a framework for a fitness training programme proposed for 2R22R. The discussion will be limited to the three principles of training which are;

(i) the intensity, duration and frequency of exercise,

(ii) the initial level of fitness, and

(iii) the level of fitness to be achieved.

Whereas the frequency and duration of exercise are easy to define, the intensity is much more difficult. The training programme, in its final format, should consist of a minimum of three 30 minute periods of aerobic exercise each week. Although ideally the exercise should produce and maintain a training heart rate of at least 150, 140 or 130 beats per minute for men aged 20, 30 and 40 years, respectively, it must be assumed that few individuals can monitor their heart rate with any accuracy. If running or walking is the exercise of choice then the intensity can be defined in terms of time and distance. The efficiency of swimming varies so much from individual to individual that time and distance may not accurately indicate energy cost. The intensity of exercise involved in competitive sports such as ice hockey or badminton depends very much on motivation, skill and position (eg. defenceman or forward). Since it is relatively easy to define a suitable intensity, running is probably the most appropriate form of exercise for any training programme supplemented by an appropriate sports programme.

Initial fitness level, age and general health determine how rapidly an individual can progress in any training programme. Those individuals who were shown by the health and aerobic fitness assessment to have a poor level of aerobic fitness or to be obese, and those over 40 years of age who are unaccustomed to regular exercise should begin with a light exercise of short duration and progress over ten weeks (or more) to the final format (3 x 30 minutes per week). An individualized programme is essential to maintain interest and enthusiastic participation.

The level of fitness to be achieved should take into account that not everyone will be sufficiently dedicated to maintain the strenuous programme necessary to reach the excellent category of aerobic fitness (see Figure 1). The fitness level described as good will provide most of the health benefits and is relatively easy to achieve and maintain by 3 x 30 minutes per week.

The principles of training discussed above have been used to construct a progressive programme of walking and running suitable for all ages (Table 3). Time and distance have been calculated from 80% of VO_2 max for the fitness categories poor, fair and good (see Figure 1) using the formula of Margaria et al. (5). Those individuals assessed by the health and aerobic fitness assessment as being in the categories poor, fair or good should enter the programme at stages 1, 2 or 3, respectively. The objectives of the programme are to accustom each individual to running and to bring him to a level of fitness where he can run three miles in about 30 minutes three times a week (the final format). This training regimen will maintain aerobic fitness in at least the good (level 4) category. Those assessed as excellent have no requirement for suggestions on fitness training and should continue with their own individual programmes.

Finally it should be emphasized that fitness is only one component of a healthy lifestyle. Poor nutrition, cigarette smoking and excessive alcohol consumption are also recognized as potential health hazards which merit the same attention as fitness.

TABLE 1

A COMPARISON OF VO_2 MAX FOR 2R22R, OTHER CF PERSONNEL AND CANADIAN CIVILIANS

2R22R		Other CF Personnel		Canadian Civilians	
Age Group	Mean VO_2 max (ml/kg. min)	Age Group	Mean VO_2 max (ml/kg. min)	Age Group	Mean VO_2 max (ml/kg. min)
18-24 yr.	49.2 (162)	18-24 yr.	44.1 (369)	-	-
25-29 yr.	41.5 (65)	25-29 yr.	38.6 (302)	-	-
18-29 yr.	47.0 (227)	18-29 yr.	41.6 (671)	15-29 yr.	39.9 (215)
30-39 yr.	37.2 (145)	30-39 yr.	34.5 (554)	30-39 yr.	32.2 (163)
40-59 yr.	31.5 (58)	40-59 yr.	31.2 (446)	40-59 yr.	26.4 (147)

Numbers of subjects tested are shown in parentheses.

TABLE 2

A COMPARISON OF MEAN VO_2 MAX FOR 2R22R WITH

THAT OF SELECTED MILITARY AND CIVILIAN GROUPS

Group	Mean VO_2 Max (ml/kg. min)		
	18-29 yr.	30-39 yr.	40-59 yr.
2R22R	47.0 (227)	37.2 (145)	31.5 (58)
1RCR and 3RCR	47.5 (123)	-	-
HMCS Huron and Okanagan	36.8 (157)	34.5 (111)	34.2 (22)
CFB North Bay and CFB Portage	38.6 (248)	33.3 (323)	30.5 (267)
BOTC CFB Chilliwack	51.7 (60)	-	-
US Infantry	50.5 (286)	-	-
NHL Officials	49.9 (33)	-	-

Number of subjects tested are shown in parentheses.

TABLE 3

SUGGESTED TIMES AND DISTANCES FOR A PROGRESSIVE PROGRAMME OF WALKING AND RUNNING (THREE TIMES PER WEEK)

Stage	Distance (miles)	Time (minutes)			
		18-24 yr.	25-29 yr.	30-39 yr.	40-59 yr.
1 (two weeks)	2	28	29	33	36
2 (three weeks)	2	28-20.5	29-21.5	33-24	36-27
3 (five weeks)	2	20.5-16	21.5-17	24-19	27-21
Final Format	3	31-25	33-26	37-29	41-32

Those individuals assessed as poor, fair or good enter the programme at stages 1, 2 or 3, respectively.

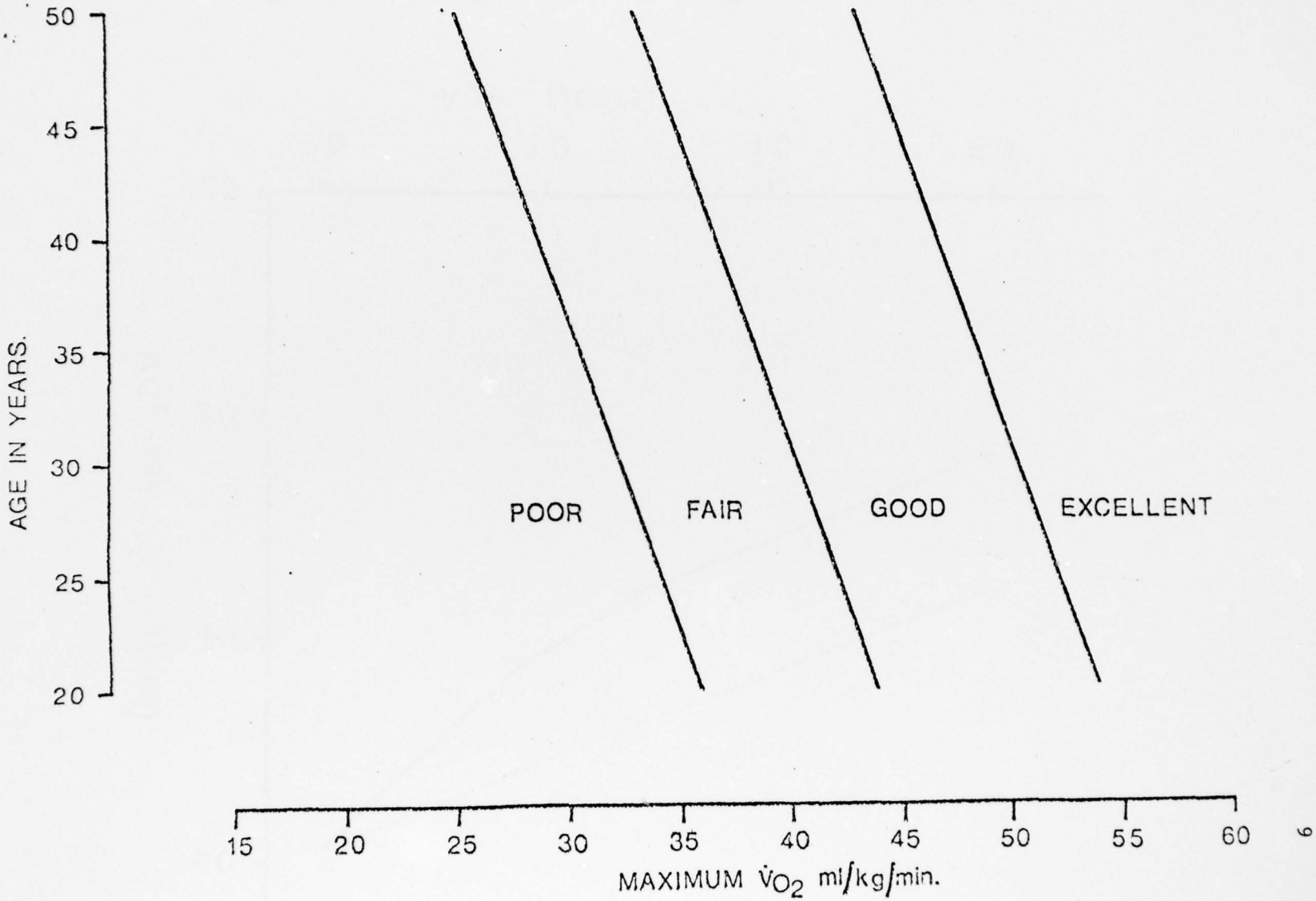

Figure 1: Categories of VO_2 max

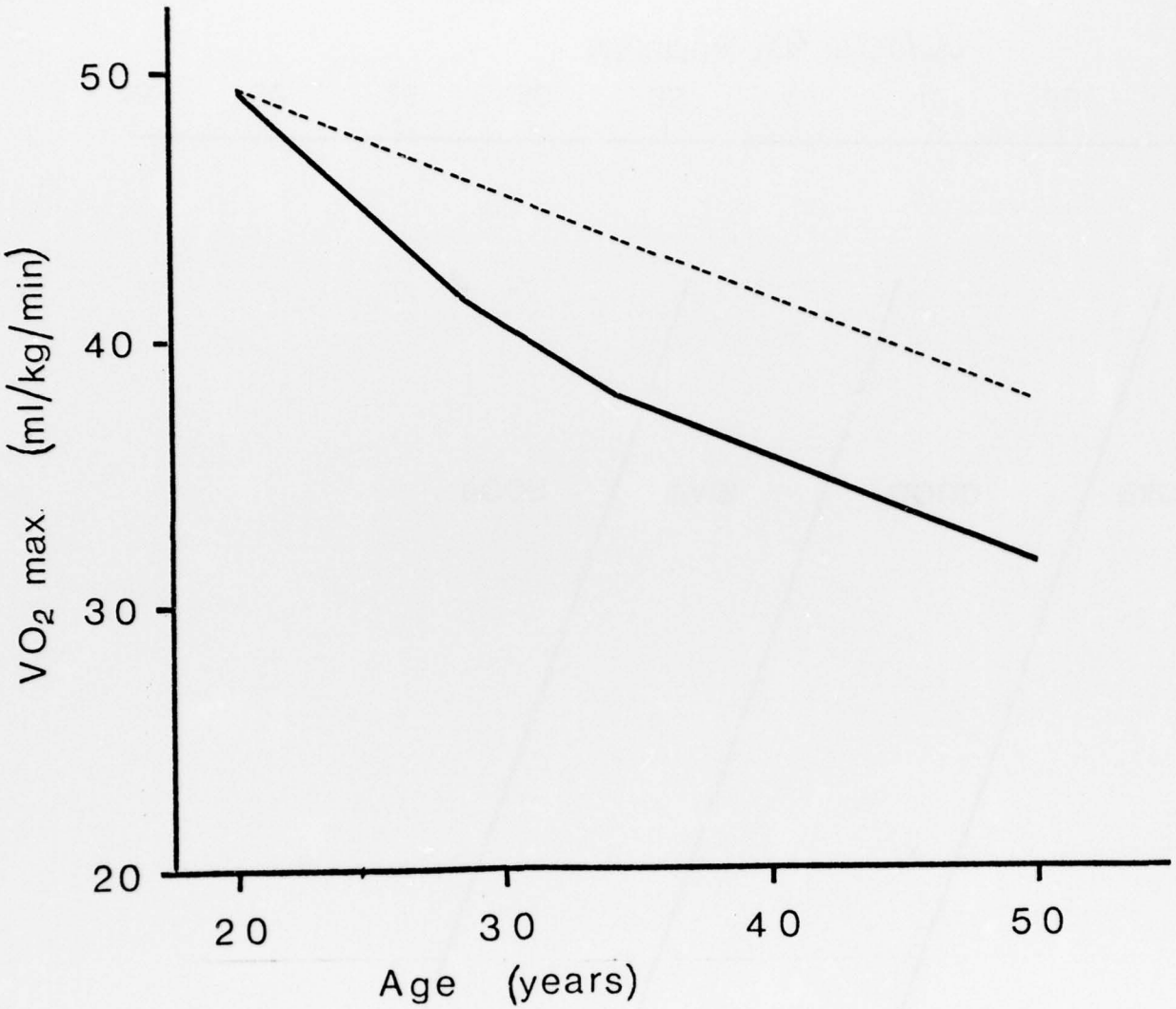

Figure 2: Decline in VO_2 max with aging, measured (——) and predicted (------)

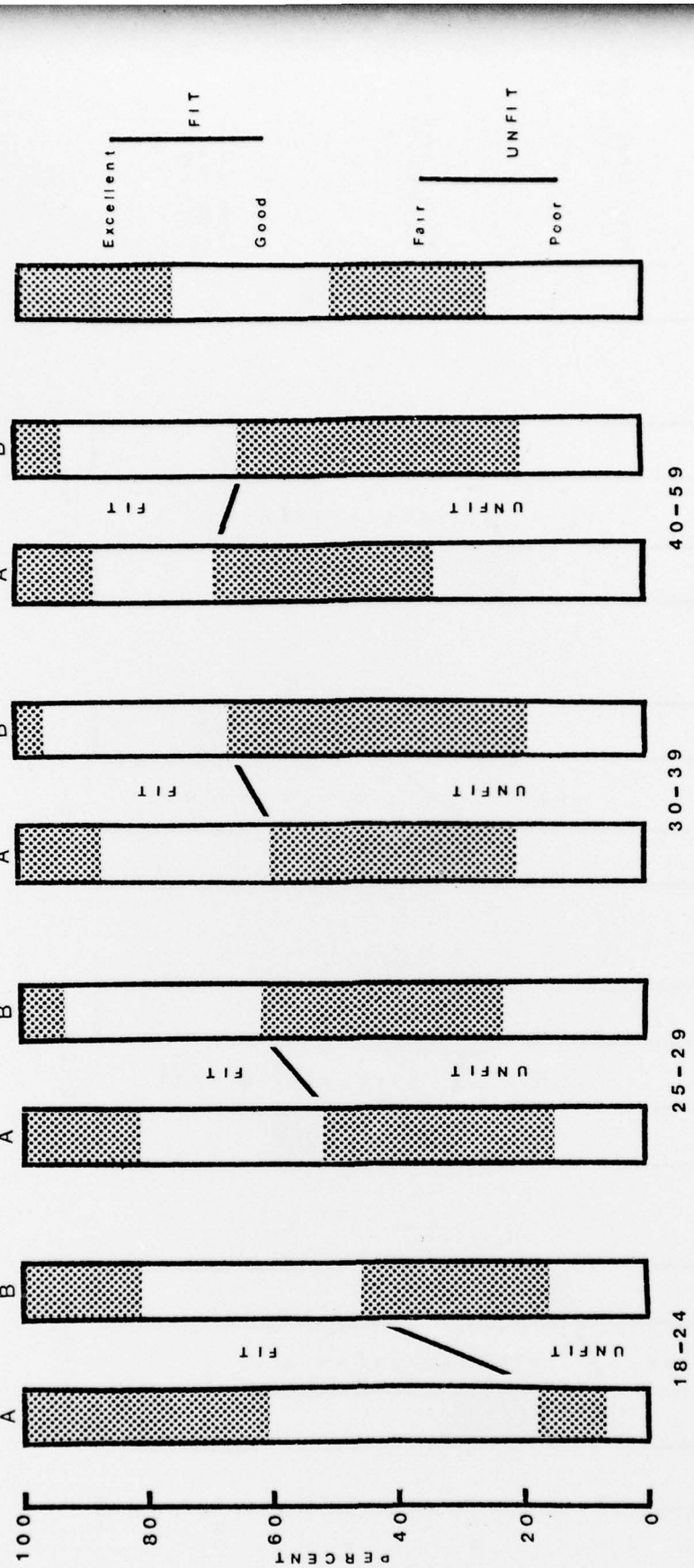

Figure 3 : DISTRIBUTION INTO CATEGORIES OF VO_2 MAX FOR 2^e R22R (A) AND OTHER CF PERSONNEL (B)

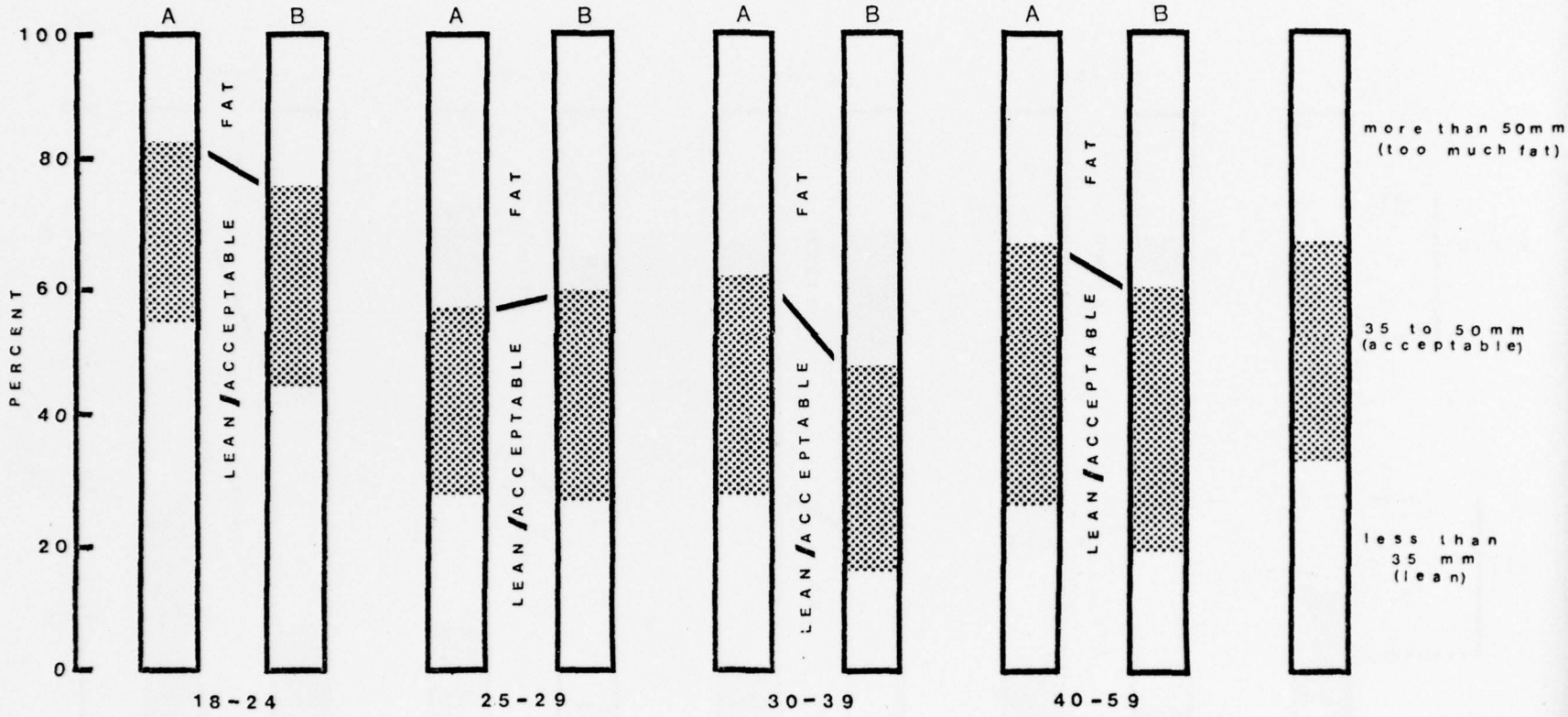

Figure 4: DISTRIBUTION INTO CATEGORIES OF SKINFOLD THICKNESS FOR 2e R22R (A) AND OTHER CF PERSONNEL (B)

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Unclassified

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)

1. ORIGINATING ACTIVITY

DCIEM

2a. DOCUMENT SECURITY CLASSIFICATION

Unclassified

2b. GROUP

3. DOCUMENT TITLE

(6) A HEALTH AND AEROBIC FITNESS ASSESSMENT OF THE 2nd BATTALION, ROYAL 22nd REGIMENT, QUEBEC CITY.

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

(9) Technical rept.

5. AUTHOR(S) (Last name, first name, middle initial)

(10) Myles, W.S. / Townshend, R.D. / Brown, T.E.

6. DOCUMENT DATE

(11) March, 1977

7a. TOTAL NO. OF PAGES

15

7b. NO. OF REFS

5

8a. PROJECT OR GRANT NO.

(12) 19p.

9a. ORIGINATOR'S DOCUMENT NUMBER(S)

(14) DCIEM-TR-77-X-12

~~77X12~~

8b. CONTRACT NO.

9b. OTHER DOCUMENT NO.(S) (Any other numbers that may be assigned this document)

10. DISTRIBUTION STATEMENT

Unlimited

11. SUPPLEMENTARY NOTES

12. SPONSORING ACTIVITY

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DSIS
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KEY WORDS

aerobic fitness assessment, body composition, fitness training programmes, infantry soldiers, skinfold thickness, fitness in the military

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